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### HIGHLIGHTED ARTICLES

#### *Scenario dependence of the climate response to cumulative carbon emissions*

Geophysical Research Letters

**J.P. Krasting, J.P. Dunne, E. Shevliakova, and R.J. Stouffer (OAR/GFDL)**

- GFDL's Earth System Model was used to quantify the sensitivity of the climate response to cumulative carbon emissions.
- This methodology allows the coupled model with a fully-interactive carbon cycle to predict its own atmospheric CO<sub>2</sub> concentration and respond with its full suite of interactions and feedbacks.
- The new method highlights the limitations of previous studies using simple models, and shows that in an Earth system model with fully-interactive carbon cycle, the climate-carbon-cycle system responds differently based on past rates and timescales of emissions.

Previous studies have relied on simple coupled climate models, with most showing that the cessation of carbon emissions results in a stabilization or even decrease of global mean surface air temperature. This methodology allows the coupled model with a fully-interactive carbon cycle to predict its own atmospheric CO<sub>2</sub> concentration and respond with its full suite of interactions and feedbacks. There is a 20% difference (0.76 to 0.98 °C/TtC) in the response to cumulative carbon emissions at the time of atmospheric CO<sub>2</sub> doubling when the GFDL-ESM2G model is forced with varying linear rates of carbon emissions. Capping carbon emissions at lower levels (5 GtC/year) as opposed to higher levels (25 GtC/year) produces less warming per emitted carbon.

Expected Publication Date: May 2014

#### *Loggerhead sea turtle abundance at a foraging hotspot in the eastern Pacific Ocean: implications for at-sea conservation*

Endangered Species Research

**J.A. Seminoff, T. Eguchi, J. Carretta, C.D. Allen, D. Prosperi, R. Rangel, J.W. Gilpatrick, Jr., K. Forney, and S.H. Peckham (NMFS/SWFSC)**

- Authors recorded over 40,000 loggerhead sea turtles occurring in the Baja California







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Peninsula (BCP) foraging habitat per survey season from 2005-2007.

- Based on the abundance estimate and already published mortality rates, authors estimate that up to 50% of the loggerhead turtles residing in BCP in any given year will die within 15 years if current mortality rates continue.
- The authors' findings underscore the urgent need to minimize anthropogenic and natural mortality on local loggerheads.

The Pacific Coast of the Baja California Peninsula (BCP), Mexico, is a hotspot for foraging juvenile loggerhead turtles (*Caretta caretta*) originating from nesting beaches in Japan. This region is also known for anthropogenic mortality of thousands of turtles annually, owing to direct harvest and fisheries bycatch. To put the conservation implications of this mortality into biological context, authors conducted aerial surveys from 2005-2007 in the Gulf of Ulloa along the BCP Pacific Coast to determine the density, distribution, and abundance of loggerhead turtles, and used *in situ* dive data to derive the proportion of time that loggerheads were at the surface and visible to surveyors. The calculated mean annual abundance of 43,226 loggerhead turtles (CV=0.51, 95% CI range = 15,017 to 100,444) represents the first abundance estimate for foraging North Pacific loggerheads based on robust analytical approaches. The density estimate confirms the BCP is a major foraging area for loggerhead turtles in the North Pacific. In combination with published annual mortality estimates of loggerheads near BCP based on beach surveys, these results suggest that up to 11% of the region's loggerhead population may perish each year due to anthropogenic and/or natural threats. Furthermore, authors estimate that up to 50% of the loggerhead turtles residing in BCP in any given year will die within 15 years if current mortality rates continue. These findings underscore the urgent need to minimize anthropogenic and natural mortality on local loggerheads.

Expected Publication Date: Spring 2014

*Inferring past demographic changes in a critically endangered marine fish after fishery collapse*

ICES Journal of Marine Science

F. Valenzuela-Quíñonez, **J.C. Garza (NMFS/SWFSC)**, J.A. De-Anda-Montañez, and F.J. García-de-León

- The study represents the first genetic evaluation of totoaba, the largest sciaenid fish and the first marine fish to be listed under the Endangered Species Act.





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- In the Gulf of California totoaba has not suffered a measurable contemporary reduction in genetic diversity, and that genetic diversity is driven by long-term climatic events.
- The authors concluded that the recent fishery collapse of totoaba did not have sufficient consequences at the genetic level to increase the risk of extinction, however selective effects of fishing remain unclear.

Several worldwide marine fish stocks need to recover from collapse or overexploitation. However, the effects of a fishery collapse at the genetic level are still largely unknown, as is the extent of reduction in genetic diversity caused by fisheries and the consequences for extinction risk. The authors present a case study for totoaba, the first marine fish considered as critically endangered. The authors assessed 16 microsatellite loci to determine whether the demographic collapse of the species resulted in a loss of genetic diversity. Results indicated that genetic diversity of totoaba is in the range of values observed for fish with similar biological traits and no documented fishery collapse could be evidenced. Contemporary demographic analysis indicated no loss of genetic diversity. Long-term genealogical analysis showed a substantial reduction in effective population size. However, the time and causal effects for population decline cannot be inferred because of the large uncertainty in estimates. These results indicate that the totoaba in the Gulf of California has not suffered a measurable contemporary reduction in genetic diversity and that genetic diversity is driven by long-term climatic events. Estimates of current effective size indicate that it is large enough that genetic factors may not be a major problem for conservation. The authors concluded that the recent fishery collapse of totoaba did not have sufficient consequences at the genetic level to increase the risk of extinction from genetic drift. However, selective effects of fishing on the adaptive potential in totoaba remain unclear.

Accepted: March 5, 2014

*Spatio-temporal dynamics of ocean conditions and forage taxa reveals regional structuring of seabird-prey relationships*

Ecological Applications

**Santora, J.A., I.D. Schroeder, J.C. Field, B.K. Wells, and W.J. Sydeman (NMFS/SWFSC)**

- This paper documents coherence between physical ocean conditions and the





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distribution of juvenile groundfish and other forage species

- The results generally indicate that prey availability in the shelf region of the entire study area is of importance to seabirds, with stronger correlations and demographic response relationships from the areas of greatest proximity to seabird colonies.
- Studies of this kind demonstrate the possibility of delineating specific critical areas where the implementation of protective measures could maintain functions and productivity of central place foraging predators.

Studies of predator-prey demographic responses and the physical drivers of such relationships are rare, yet essential for predicting future changes in the structure and dynamics of marine ecosystems. Here, the authors hypothesize that predator-prey relationships vary spatially in association with underlying physical ocean conditions, leading to observable changes in demographic rates, such as reproduction. To test this hypothesis, the authors quantified spatio-temporal variability in hydrographic conditions, krill, and forage fish to model predator (seabird) demographic responses over 18 years (1990-2007). They used principal component analysis and spatial correlation maps to assess coherence among ocean conditions, krill, and forage fish, and generalized additive models to quantify interannual variability in seabird breeding success relative to prey abundance. The first principal component of 4 hydrographic measurements yielded an index that partitioned "weak/warm upwelling" and "strong/cool upwelling" years. Partitioning of krill and forage fish time series among shelf and oceanic regions yielded spatially-explicit indicators of prey availability. Krill abundance within the oceanic region was remarkably consistent between years, whereas krill over the shelf showed marked interannual fluctuations in relation to ocean conditions. Anchovy abundance varied on the shelf, and was greater in years of strong stratification/weak upwelling and warmer temperatures. Spatiotemporal variability of juvenile forage fish covaried strongly with each other and with krill, but was weakly correlated with hydrographic conditions. Demographic responses between seabirds and prey availability revealed spatially-variable associations indicative of the dynamic nature of habitat-prey relationships. Quantification of spatially-explicit demographic responses, and their variability through time, demonstrates the possibility of delineating specific critical areas where the implementation of protective measures could maintain functions and productivity of central place foraging predators.

Expected Publication Date: Summer 2014







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Pre-Print Online: <http://www.esajournals.org/doi/pdf/10.1890/13-1605.1>

*Determining the willingness to pay for ecosystem service restoration in a degraded coastal watershed: A ninth grade investigation*

Ecological Economics

K. Nicosia, S. Daaram, B. Edelman, L. Gedrich, E. He, S. McNeilly, V. Shenoy, A. Velagapudi, W. Wu, L. Zhang, A. Barvalia, V. Bokka, B. Chan, J. Chiu, S. Dhulipalla, V. Hernandez, J. Jeon, P. Kanukollu, P. Kravets, A. Mantha, C. Miranda, V. Nigam, M. Patel, S. Praveen, T. Sang, S. Upadhyay, T. Varma, C. Xu, B. Yalamanchi, M. Zharova, A. Zheng, R. Verma, J. Vasslides, **J. Manderson (NMFS/NEFSC)**, R. Jordan, and S. Gray

- Over the course of one school year, a high school biology class and a local watershed partnership collaborated to determine the willingness to pay for ecosystem service restoration in a local degraded watershed.
- The aims of this collaboration were to: (1) integrate quantitative social science into the K-12 science curriculum to foster learning about the nature of social science investigation in a real-world context; (2) create a community-based science partnership; and (3) generate social science data useful for decision-making that could withstand scientific peer review.
- Authors highlight that education is a critical component of ecosystem assessment and ecosystem based management and that enlisting school children can streamline the ecosystem scoping process which can be cumbersome and contentious amongst self-interested adults.

Over the course of a school year, a high school biology class and a local watershed partnership worked together to design a study to determine the willingness to pay for ecosystem service restoration in a local degraded watershed. With research control given to the teacher and her classroom as part of their in-class honors biology curriculum, the result was a student-designed/written and professionally structured research manuscript. The aims of this collaboration were to: (1) integrate quantitative social science into the K-12 science curriculum to foster learning about the nature of social science investigation in a real-world context; (2) create a community-based science partnership; and (3) generate social science data useful for decision-making that could withstand scientific peer review. In this commentary, authors present the written product of the classrooms' work to illustrate the type of information that can be generated by a participatory science education







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program, along with a reflection from the students and project researchers about opportunities and barriers to conducting authentic social science research in K–12 classrooms.

Pre-Print Online: <http://www.sciencedirect.com/science/article/pii/S0921800914000469>

### ADDITIONAL ARTICLES

*Evolution of pygmy angelfishes: Recent divergences, introgression, and the usefulness of color in taxonomy*

Molecular Phylogenetics and Evolution

M.R. Gaither, **J. K. Schultz (NMFS/OPR)**, D.R. Bellwood, R.L. Pyle, J.D. DiBattista, L.A. Rocha, and B.W. Bowen

- Results of genetic analyses indicate a need for taxonomic reorganization of pygmy angelfishes.
- Angelfishes are of interest because they have been petitioned for listing under Endangered Species Act due to overexploitation by the aquarium trade.

The pygmy angelfishes (family Pomacanthidae, genus *Centropyge*) occupy reef habitats in every tropical ocean and have striking coloration that can command thousands of U.S. dollars in the aquarium trade. Closely related species are often distinguished only by coloration, but some species are rarely observed visually because they occur below conventional scuba depths. These factors impede phylogenetic resolution; every phylogeographic survey to date has reported discordance between coloration, taxonomy, and genetic partitions. Here we report a phylogenetic survey of 29 of the 34 recognized species (N = 94 plus 23 outgroups), based on two mitochondrial DNA and three nuclear loci, totaling 2272 base pairs. The resulting Maximum Likelihood and Bayesian trees are highly concordant with each other and a previous analysis of Pomacanthidae, indicating that *Centropyge* is paraphyletic with respect to *Apolemichthys* and *Genicanthus*, two recognized genera (i.e., they nest within *Centropyge*). Additionally, the subgenera *Xiphypops* and *Paracentropyge* comprise monophyletic lineages (i.e., they form their own genetic clades) and should be elevated to genus level. Based on an age estimate of 38 *megaannum* (Ma) for the family Pomacanthidae, *Centropyge* diverged from the closest





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extant genus *Pygoplites* about 33 Ma, three deep lineages within *Centropyge* diverged about 18–28 Ma, and four species complexes diverged 3–12 Ma. However, in 11 of 13 cases, supposed species in these complexes are indistinguishable based on morphology and genetics, being defined solely by coloration. These cases indicate either emerging species or excessive taxonomic splitting based on brightly colored variants.

Published Online: <http://www.sciencedirect.com/science/article/pii/S105579031400030X>

*Description of the eudoxid stages of Lensia havock and Lensia leloupi (Cnidaria: Siphonophora: Calycophorae), with a review of all known Lensia eudoxid bracts*  
Systematics and Biodiversity

M.M. Grossman, **A.G. Collins (NMFS/NEFSC/NSL)**, and D.J. Lindsay

- The authors use DNA barcoding to link eudoxid stages, or free-living sexual units released by calycophoran siphonophores, to their polygastric stages
- Elucidating biodiversity through sound systematics is of foundational importance to ecosystem management.
- This paper advances systematics of siphonophores, one of the most abundant and ecologically important groups of gelatinous zooplankton

The majority of calycophoran siphonophores release cormidia from the end of the polygastric colony to form a free-living sexual unit, called the eudoxid stage. Despite having a very different morphology from that of the polygastric colony, nearly all calycophoran species have had their eudoxid stages described, through a combination of morphological and distributional similarities with the polygastric stages. However, in the catch-all genus *Lensia*, less than half of the small rocket-shaped polygastric stages have had eudoxid stages assigned to them. In this work, DNA barcoding of the mitochondrial 16S gene allowed two new *Lensia* eudoxid stages to be reliably linked with their polygastric stages: *L. havock* and *L. leloupi*. A re-examination of the latter species has indicated that *L. nagabhushanami* is a junior synonym. A review of all known *Lensia* eudoxid bracts is given, with some notes on five as-yet unassigned eudoxid stages.

Accepted: March 6, 2014

*Antarctic mixotrophic protist abundances by microscopy and molecular methods*  
FEMS Microbiology Ecology

R.J. Gast, Z. McKie-Krisberg, S. Fay, **J.M. Rose (NMFS/NEFSC)**, and R.W. Sanders





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- Authors use molecular methods to identify mixotrophic algae, or those that combine phototrophic and heterotrophic strategies, from Antarctic field samples
- Abundance of Antarctic mixotrophic protists was strongly influenced by season, more than by sampling year or sampling location. When nutrients were included in the analysis, phosphate was identified as an additional significant explanatory variable.
- The contribution of known mixotrophs (from cultures) to grazing on bacterial populations was generally low in field samples. Most mixotrophs still remain unidentifiable by traditional microscope- and culture-based methods.

Protists are traditionally described as either phototrophic or heterotrophic, but studies have indicated that mixotrophic species, organisms that combine both strategies, can have significant impacts on prey populations in marine microbial food webs. While estimates of active mixotroph abundances in environmental samples are determined microscopically by fluorescent particle ingestion, species identification is difficult. The authors developed SYBR-based qPCR strategies for three Antarctic algal species that were identified as mixotrophic. This method and traditional ingestion experiments were then applied to determine the total mixotroph abundance in Antarctic water samples, to ascertain the abundance of known mixotrophic species and to identify environmental variables that impact the distribution and abundance of these species. Despite differences in sampling locations and years, mixotroph distribution was most strongly influenced by season. Environmental variables that best explained variation in the individual mixotroph species abundances were temperature, oxygen, fluorescence and latitude. Phosphate was identified as an additional explanatory variable when nutrients were included in the analysis. Utilizing culture-based grazing rates and qPCR abundances, the estimated summed impact on bacterial populations by the three mixotrophs was usually < 2% of the overall mixotrophic grazing, but in one sample *Pyramimonas* was estimated to remove > 23% of the daily bacterial standing stock.

Accepted: March 19, 2014

*Influence of oceanic Rossby waves on phytoplankton production in the southern tropical Indian Ocean*

Journal of Marine Science

J. Ma, Y. Du, H. Zhan, H. Liu, and **J. Wang (NOAA/GLERL)**







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- Due to the effects on the thermocline dome between downwelling and upwelling Rossby waves, higher chlorophyll concentrations appear earlier in the eastern part of the dome, whereas lower chlorophyll concentrations appear later in the central part of the dome.
- Responses are stronger when El Niño/La Niña–Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) events coincide.
- These findings are important for monitoring and interpreting changes in coastal ecosystem health.

Using Sea-viewing Wide Field-of-view Sensor (SeaWiFS) ocean color data, the authors investigated the biological responses to oceanic Rossby waves in the southern tropical Indian Ocean (TIO) between 1997 and 2007. Their findings indicate that during the developing phase of El Niño/La Niña events, usually in boreal fall, and triggered by anomalous anticyclonic/cyclonic wind circulations in the southeast TIO, downwelling/upwelling Rossby waves form and then propagate westward. After a few months, downwelling/upwelling Rossby waves interface with the thermocline dome in the southern TIO, and suppress/enhance the upwelling. Correspondingly, less/more nutrient-rich waters enter the mixed layer and result in lower/higher chlorophyll concentrations. Due to the asymmetric effects on the thermocline dome between downwelling and upwelling Rossby waves, higher chlorophyll concentrations appear earlier and in the eastern part of the dome, whereas lower chlorophyll concentrations appear later and in the central part of the dome. Moreover, the authors concluded that when El Niño/La Niña–Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) events coincide, the biological responses are stronger.

Published: March 13, 2014

#### *Discontinuities, cross-scale patterns, and the organization of ecosystems*

##### Ecology

K.L. Nash, C.R. Asseln, D.G. Angeler, C. Barichievy, T. Eason, A.S. Garmestani, N. Graham, D. Granholm, M. Knutson, R. Nelson, M. Nystrom, **C.A. Stow** (NOAA/OAR/GLERL), and S. Sundstrom

- Discontinuities can be useful to identify scale breaks and to examine the organization of ecosystems.
- Discontinuity analysis offers a powerful tool for investigating cross-scale





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interactions, and provides a platform from which to assess the distribution of key traits or processes within and across the scales of any given ecosystem.

Ecological structures and processes occur at specific spatiotemporal scales, and interactions that occur across multiple scales mediate scale-specific (e.g., individual, community, local, or regional) responses to disturbance. Despite the importance of scale, explicitly incorporating a multi-scale perspective into research and management actions remains a challenge. The discontinuity hypothesis provides a fertile avenue for addressing this problem by linking measurable proxies to inherent scales of structure within ecosystems. The authors outline the conceptual framework underlying discontinuities and review the evidence supporting the discontinuity hypothesis in ecological systems. Additionally, they explore the utility of this approach for understanding cross-scale patterns and the organization of ecosystems by describing recent advances for examining nonlinear responses to disturbance and phenomena such as extinctions, invasions, and resilience. To stimulate new research, they present methods for performing discontinuity analysis, detail outstanding knowledge gaps, and discuss potential approaches for addressing these gaps.

Published: March 2014

<http://www.esajournals.org/doi/abs/10.1890/13-1315.1>

*Depth-related distribution of post-juvenile red snapper in southeastern U.S. Atlantic Ocean waters: ontogenetic patterns and implications for management*

Marine and Coastal Fisheries: Dynamics, Management and Ecosystem Science

**W.A. Mitchell, G.T. Kellison, N.M. Bacheler, J.C. Potts, C.M. Schobernd (NMFS/SEFSC, Beaufort, NC), and L. F. Hale (NMFS/SEFSC, Panama City, FL)**

- The results do not support assertions of greater abundances of older and larger red snapper in deeper southeastern U.S. Atlantic Ocean waters, as theorized by stakeholders and as potentially occurs in the Gulf of Mexico.
- The cessation of increasing depth with age once a critical age or size is obtained may be common and perhaps widespread.

For the economically and ecologically important red snapper (*Lutjanus campechanus*), depth distribution patterns throughout its life stages are not well understood, particularly in the southeastern U.S. Atlantic Ocean (SEUSA). Using data derived from two fishery-independent surveys targeting hardbottom habitats, the authors examined patterns of age-





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and length-specific depth distributions of post-juvenile (age-1+) red snapper in the SEUSA. They also compared age and length distributions between fishery-independent surveys and commercial hook-and-line catches to make inferences about gear-specific age and size selectivity, with implications for gear-specific interpretations of red snapper depth distribution patterns and for determining selectivity functions used in stock assessments. Older, larger red snapper were generally distributed throughout all depths, whereas the younger and smaller Red Snapper occurred disproportionately in relatively shallow waters. For red snapper larger than 50 cm fork length (FL), the authors found no evidence of a positive relationship between depth and age or length. Additionally, age and length distributions of red snapper > 50 cm FL did not differ between fishery-independent surveys and the commercial hook-and-line fishery. These results provide no support for assertions of greater abundances of older and larger red snapper in deeper SEUSA waters. As observed in this study for red snapper in SEUSA waters, the authors suggest that patterns of increasing age and size with depth for multiple reef-associated fish species in SEUSA and Gulf of Mexico waters may be driven by younger and smaller fish occurring in shallower waters, with older and larger fish distributed more equally across depths. Analyses to test this hypothesis for multiple species would be informative for their assessment and management, and are recommended.

Accepted: March 11, 2014

*Spatial and temporal patterns in summer ichthyoplankton assemblages on the eastern Bering Sea shelf 1996–2007*

Fisheries Oceanography

**M.S. Busby, J.T. Duffy-Anderson, K.L. Mier, and L.G. De Forest**  
**(NMFS/AKFSC)**

- Larval and early juvenile fishes were collected from 1996–2005 and in 2007 to determine spatial and temporal patterns in species abundance and structure.
- The authors found supporting evidence that oceanographic conditions, specifically water temperature and sea-ice coverage, affect the spatial and temporal pattern of larval abundances of commercially important species of fishes.

Larval and early juvenile fishes were sampled from the eastern Bering Sea (EBS) shelf from 2001 to 2005, and in 2007. Data from these collections were used to examine spatial and temporal patterns in species assemblage structure and abundance. The years 2001–







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2005 were unusual because the EBS water temperature was ‘warm’ compared with the long-term mean temperature. In contrast, 2007 was a ‘cold’ year. The abundance of the five most numerous taxa at 12 stations common to all years sampled (1996–2005, 2007) were significantly different among years. Larval and early juvenile stage *Theragra chalcogramma* (walleye pollock), a commercially important gadid, were by far the most abundant fish in all years. Bottom depth alone best explained assemblage structure in most years, but in others, bottom depth and water column temperature combined and percent sea-ice coverage were most important. Abundance of *T. chalcogramma* larvae increases with water column temperature until 5°C and then becomes level. Higher abundances of *Gadus macrocephalus* (Pacific cod) larvae occur in years with the greatest percent sea-ice cover as indicated by GAM analysis. Larvae of *Lepidopsetta polyxystra* (northern rock sole) increase in abundance with increasing maximum wind speed, but decrease at a later date during the last winter storm. The data are consistent with the hypothesis that oceanographic conditions, specifically water temperature and sea-ice coverage, affect the spatial and temporal pattern of larval abundances. In general, ichthyoplankton species assemblages can be important early indicators of environmental change in the Bering Sea and potentially other subarctic seas as well.

Expected Publication Date: March 11, 2014

*Residence time and habitat duration for apex predators in a small mid-Atlantic estuary*  
Fishery Bulletin

**J.P. Manderson, L.L. Stehlik, J. Pessutti, J. Rosendale, and B. Phelan**  
**(NMFS/NFSC)**

- The authors measured the residence times of fishes in an estuarine tributary in New Jersey as a function of various habitat characteristics.
- The residence times of certain fishes was found to be influenced by water temperature and freshwater discharge in this estuarine environment.

Residence times of individual fishes should reflect the durations over which habitat resources support survival, metabolic maintenance, and adequate growth. From May to November in 2006 and 2007, we measured residencies of ultrasonically tagged age-1+ Striped Bass (*Morone saxatilis*; n=46), age-0 and age-1+ Bluefish (*Pomatomus saltatrix*; n=45 and 35) and age-1+ Weakfish (*Cynoscion regalis*; n=41) in a small estuarine tributary in New Jersey with 32 ultrasonic receivers to monitor movements and sensors to





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measure habitat resources. Striped Bass and age-1+ Bluefish used the estuary for medians of 9.5 days (d) (max=58 d) and 22 d (max=88 d), and age-0 Bluefish and Weakfish were resident for medians of 30 d (max=52 d) and 41 d (max=88 d). Small individuals < 500 mm TL were likely to remain in the estuary longer at warmer temperatures than were large individuals. Size-dependent temperature responses were similar to optimal temperatures for growth reported in previous studies. Freshwater discharge also influenced residence. All species were likely to remain in the estuary until discharge rates fell to a value associated with the transition of the estuarine state from partially to fully mixed. This transition weakens flows into the upstream salt front where prey concentrations usually are high. Estuarine residence appeared to be regulated by temperatures that controlled scopes for growth and the indirect effects of freshwater discharge on prey productivity and concentration. Changes in the seasonal phenology of temperature, precipitation, and human water use could alter the durations over which small estuarine tributaries serve as suitable habitats.

Accepted: March 13, 2014

*Individual calling behaviour and movements of North Atlantic minke whales (Balaenoptera acutorostrata)*

Behaviour

**D. Risch (NMFS/OAA), U. Siebert, and S. Van Parijs (NMFS/NEFSC)**

- This study used passive acoustic arrays in Stellwagen Bank National Marine Sanctuary (SBNMS) to advance understanding of minke whale calling behavior.
- The authors found that whales seemed to adopt different patterns of calling when in hearing range of one another, suggesting social interactions.
- The authors also tracked swimming speeds using this method, confirming SBNMS as a migration route.

Information on individual calling behaviour and source levels are important for understanding social interactions of marine mammals, for which visual observations are difficult to obtain. The study, conducted in the Stellwagen Bank National Marine Sanctuary (SBNMS), located in the Gulf of Maine, USA, used passive acoustic arrays to track North Atlantic minke whales and assess the sound production behaviour of individuals. A total of 18 minke whales were acoustically tracked in this study. Individual calling rates were variable, with a median intercall interval (ICI) of 60.3 s. Average source





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levels (SLrms) for minke whales pulse trains ranged between 164 and 168 dB re 1 $\mu$ Pa, resulting in a minimum detection range of 0.4–10.2 km for these calls in this urban, coastal environment. All tracked animals were actively swimming at a speed of  $5.0 \pm 1.2$  km/h, which matches swimming speeds of migrating minke whales from other areas and confirms SBNMS as part of the migration route of this species in the Western North Atlantic. Tracked minke whales produced 7 discrete call types belonging to 3 main categories, yet no individual produced all call types. Instead, minke whales produced 2 multisyllabic call sequences (A and B) by combining 3–4 different call types in a non-random order. While 7 of the tracked individuals produced calling pattern A, 10 whales used calling pattern B, and only 1 animal combined call types differently. Animals producing different call sequences were in acoustic range of one another on several occasions, suggesting they may use these sequences for mediating social interactions. The fact that the same calling patterns were shared by several individuals suggests that these patterns may contain information related to sex, age or behavioral context.

Published Online:

<http://booksandjournals.brillonline.com/content/journals/10.1163/1568539x-00003187;jsessionid=49j7lvio3db65.x-brill-live-02>

*Killifish habitat suitability as a measure of coastal restoration performance: integrating field data, behavioral trials and simulation*

Ecological Indicators

L.C. McManus, S. Yurek, P.B. Teare, T.E. Dolan and **J.E. Serafy (NMFS/SEFSC)**

- This study demonstrates a multi-pronged approach for comparing the performance of different freshwater flow management scenarios from the Comprehensive Everglades Restoration Plan in terms of gain/loss of coastal habitats suitable for native flora and fauna
- The results suggest that continued tracking of goldspotted killifish is warranted for its utility as a biological indicator of nearshore salinity conditions

One of the goals of the Comprehensive Everglades Restoration Plan (CERP) is to restore more natural salinity regimes to the coastal bays of South Florida (USA) with the aim of improving their degraded estuarine function (e.g., as productive feeding and nursery areas). In this study, the authors examined the occurrence (presence-absence) and concentration (presence-only fish density) of goldspotted killifish (*Floridichthys carpio*)







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observed in an ongoing fish survey as potential indicators of restoration performance in Biscayne Bay, Florida. To determine *F. carpio* salinity affinity, they applied regression analyses to field data and performed behavioral choice trials in the laboratory, whereby individuals were exposed to a salinity gradient (10 – 50). Analysis of field data indicated a parabolic relationship between killifish occurrence and salinity, where occurrence is maximized at salinity ~22. Killifish concentration was unrelated to salinity. Experimental salinity choice results tended to agree with field observations of occurrence and demonstrated a preference for intermediate salinity levels (10 to 30). Finally, the authors performed a simulation exercise to compare seasonal changes in habitat suitability within our study domain over the course of one year. Seasonal comparisons were performed as a proxy for assessing different freshwater management alternatives. They applied the relationship between killifish occurrence and salinity that resulted from analyses of field data to the output of a published hydrodynamic salinity transport model. This exercise provided areal estimates of suitable habitat gained or lost, as well as maps indicating the geographic distribution of habitat quality by season. The authors conclude that: (1) continued field monitoring of goldspotted killifish occurrence is warranted for its utility as a biological indicator of nearshore salinity conditions in an ecosystem-based management framework; and (2) the regression relationships revealed by the present study may be useful in habitat suitability modeling exercises, especially those that compare impacts of different freshwater flow scenarios via computer simulation.

Accepted: March 15, 2014

*Port level fishing dynamics: assessing changes in the distribution of fishing activity over time*

Marine Policy

**C. Spier (NMFS/SWFSC)**, J.G. Sutinen, and C. Pomeroy

- Authors assess changes in distribution of commercial fishing in California's ports. Fishing activity declined between 1981 and 2007.
- Results show that ports differ in terms of their dynamic fishing activity patterns over time. Rejects null hypothesis that the cumulative percent changes at individual ports are the same as changes at the region-wide level.

This article assesses changes in the relative distribution of commercial fishing activity within a system of ports. Like other coastal fisheries in the United States, fishing activity





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declined significantly at California's central and north coast region ports between 1981 and 2007. The central questions addressed in this paper are: How have the changes in overall fishing activity (as measured by total regional fishing trips, revenues, and landings) affected fishing activity in each of the central and northern California coastal region's 30 fishing ports? How have individual ports fared relative to other ports and the region as a whole during this decline? The analysis assesses the degree to which the relative distribution of fishing activity across ports – as measured by port rankings – is stable over time. The formal rank correlation analysis shows that ports' rankings have changed slowly and have changed more over longer intervals. In addition, the rankings change less (more) when the comparison is made over a larger (smaller) set of ports. Tests for the statistical significance of differences in percentage changes in fishing activity between region-wide totals and individual ports are performed. The results indicate that ports differ in terms of their dynamic fishing activity patterns over time, which constitutes a rejection of the null hypothesis that the cumulative percent changes at individual ports are the same as changes at the region-wide level.

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*Age, growth and mortality of Yellowmouth Grouper from the southeastern United States*

Marine and Coastal Fisheries: Dynamics, Management and Ecosystem Science

**M.L. Burton, J.C. Potts, and D.R. Carr (NMFS/SEFSC, Beaufort, NC)**

- This paper adds to the knowledge of life history parameters of previously unstudied species in the south Atlantic, generating data necessary for ecosystem based management.
- Yellowmouth Grouper age ranged from 3 to 31 years, and the largest fish was 859 mm FL.
- This is the first published use of a new method to estimate natural mortality in grouper. These estimates can be used to more accurately assess the abundance of this resource.

The Yellowmouth Grouper (*Mycteroperca interstitialis*) is a member of the snapper–grouper complex that is managed by the South Atlantic Fishery Management Council. There is little published life history information—specifically age–growth parameters—for use in assessing the resource. Authors sampled Yellowmouth Grouper from the fisheries





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along the southeastern U.S. coast from 1980 to 2012 ( $n = 391$ ), determining ages by counting opaque zones on sectioned sagittal otoliths. Opaque zones were annular, forming in May–August with a peak in May and June. Yellowmouth Grouper age ranged from 3 to 31 years, and the largest fish was 859 mm FL. The authors determined body size relationships and the von Bertalanffy growth equation (both size-adjusted and not) for Yellowmouth Grouper. Natural mortality ( $M$ ) estimated by Hewitt and Hoenig's (2005) longevity-based method was 0.14. Age-specific estimates of  $M$  were obtained with the Charnov et al. (2013) method. The selection of growth model (size limit adjusted versus unadjusted) had a marked effect on  $M$  for the earliest ages:  $M$  was 1.22 versus 0.43 for age 0; 0.72 versus 0.35 for age 1; 0.51 versus 0.29 for age 2; 0.40 versus 0.26 for age 3; 0.33 versus 0.23 for age 4; and 0.29 versus 0.21 for age 5. Authors believe that these life history parameter estimates are accurate for Yellowmouth Grouper in southeastern U.S. fisheries. Expected Publication Date: March 2014

#### *Choosing a universal mean wind for supercell motion*

Journal of Operational Meteorology

**M.J. Bunkers and D.A. Barber (NOAA/NWS)**

- Authors reinforce previous findings that a pressure-weighted mean wind over a relatively deep layer of the atmosphere is generally superior to a height-based mean wind for calculating supercell motion.
- Proper anticipation of the mean wind in elevated and low-topped supercell environments may help with forecaster situational awareness and decision support services for potentially high-impact severe weather.

The 0-6-km AGL layer has been used widely in operations to predict supercell motion. However, situations when a supercell is low-topped or elevated may not be well-predicted with this default mean wind—which itself could be height based or pressure weighted. These factors suggest that a single, fixed layer is not appropriate for all situations, and thus various mean-wind parameters are explored herein. In the authors' sample of 580 observed supercells and soundings, the 0–8-km AGL pressure-weighted mean wind resulted in the lowest mean absolute error (MAE, 3.19 m s<sup>-1</sup>) for supercell motion predictions. Moreover, the MAE when using the surface to 65% of the height of the most-unstable (MU) equilibrium level for the pressure-weighted mean wind is only 0.11 m s<sup>-1</sup> larger than for the 0-8-km layer, illustrating the similarity between these two options.







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Next, the MU parcel height and effective inflow-layer base were used in lieu of the surface as the base of the mean wind. This resulted in MAEs that were the same or only slightly larger than for the 0-8-km pressure-weighted mean wind (for the entire sample). A separate dataset of 829 Rapid Update Cycle 0-h forecast soundings reinforces these findings, and further shows that improved supercell motion predictions are possible for both elevated and “shallow” supercells. These results imply that a universal mean wind using a variable base and top may be a feasible replacement to the de facto 0-6-km mean wind in order to anticipate the motion of supercells for a range of environments. Expected Publication Date: April 15, 2014

#### *A high-resolution lightning map of the state of Colorado*

##### Monthly Weather Review

B.J. Vogt and **S. Hodanish (NOAA/NWS)**

- This work may lead to a greater understanding of lightning climatology in Colorado as well as other areas with highly variable terrain.
- Steep terrain gradients and increases in surface-generated turbulence enhance lightning activity therefore visual and analytical products of GIS, such as maps, histograms, and statistical measures, can help create highly detailed lightning climatologies for user-defined regions.

For the state of Colorado, seventeen years (1996 - 2012) of 1 April through 31 October cloud-to-ground (CG) lightning stroke data encompassing 18.6 million ground contact points (GCP) are mapped at 1-km spatial resolution over a 10-m spatial resolution US Geological Survey (USGS) digital elevation model (DEM). Visual interpretation of the mapped data reveals the general lightning climatology of the state while geospatial analyses that quantify lightning activity by elevation identify certain topographic influences unique to Colorado's physical landscape. Elevations lower than 1829 m (6000 ft.) and above 3200 m (10500 ft.) show a positive relationship between lightning activity and elevation while the variegated topography that lies between these two elevations is characterized by a fluctuating relationship. Though many topographic controls are elucidated through our mappings and analyses, the major finding of this paper is the sharp increase in stroke density observed above 3200 m (10500 ft.). Topography's role in this rapid surge in stroke density, which peaks in the highest mountain summits, is not well known, and until now, was not well documented at such high resolution from a long-





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duration dataset.

Expected Publication Date: June 1, 2014

*Long-term behavior at foraging sites of adult female loggerhead sea turtles (Caretta caretta) from three Florida rookeries*

Marine Biology

A.M. Foley, **B.A. Schroeder (NMFS/OPR)**, R. Hardy, S.L. MacPherson, and M. Nicholas

- Results from this study provide new information regarding occupancy of foraging sites used by adult female loggerhead turtles from three Florida rookeries.
- Resident foraging sites were identifiable and turtles were faithful to their foraging sites, in some cases migrating to an overwintering site. Most residence areas were in depths <100m.
- Information on foraging habitat use is for conservation management and recovery implementation, especially when evaluating the potential effects of anthropogenic activities planned or already occurring within or near these important habitats. The results will also help inform planning and evaluation of Endangered Species Act Critical Habitat for the species.

Authors used satellite telemetry to study behavior at foraging sites of 40 adult female loggerhead sea turtles (*Caretta caretta*) from three Florida (USA) rookeries. Foraging sites were located in four countries (USA, Mexico, the Bahamas, and Cuba). Authors were able to determine home range for 32 of the loggerheads. One turtle moved through several temporary residence areas, but the rest had a primary residence area in which they spent all or most of their time (usually >11 months per year). Twenty-four had a primary residence area that was <500 km<sup>2</sup> (mean = 191). Seven had a primary residence area that was ≥500 km<sup>2</sup> (range = 573–1907). Primary residence areas were mostly restricted to depths <100 m. Loggerheads appeared to favor areas with larger-grained sediment (gravel and rock) over areas with smaller-grained sediment (mud). Short-term departures from primary residence areas were either looping excursions, typically involving 1–2 weeks of continuous travel, or movement to a secondary residence area where turtles spent 25–45 days before returning to their primary residence area. Ten turtles had a secondary residence area, and six used it as an overwintering site. For those six turtles, the primary residence area was in





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shallow water (<17 m) in the northern half of the Gulf of Mexico, and overwintering sites were farther offshore or farther south. We documented long winter dive times (>4 hrs) for the first time in the Gulf of Mexico. Characterizing behaviors at foraging sites helps inform and assess loggerhead recovery efforts.

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